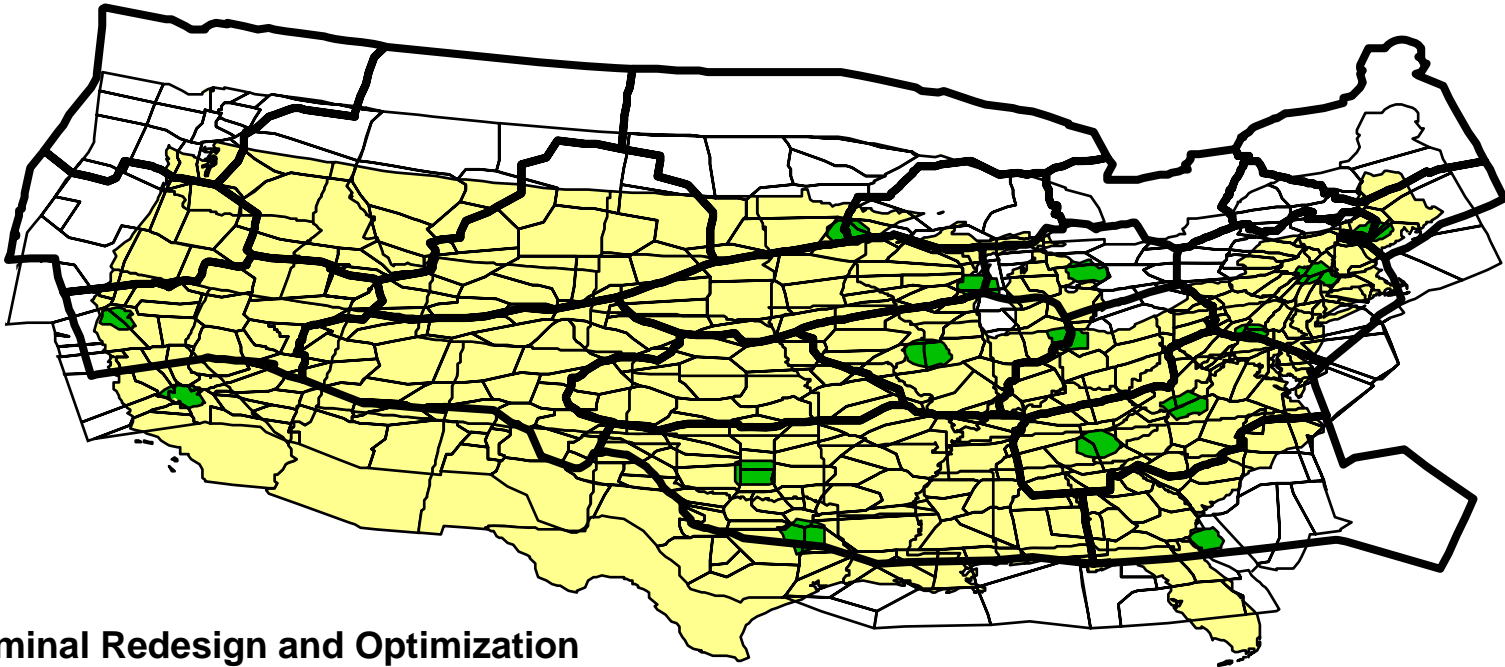


A large, stylized graphic of a globe with a grid of latitude and longitude lines. A white contrail from an aircraft is shown streaking across the upper left portion of the globe. The globe is set against a background of blue and white clouds.

GRASP and TARGETS for Airspace Analysis

Thor Abrahamsen
5 November 2003

National Airspace Redesign



Terminal Redesign and Optimization

- New Runways
- Consolidation of airspace
- New technologies

En Route Redesign and Optimization

- Accommodate terminal changes
- Volume and workload balancing

Cross Facility Coordination

- National redesign

Tools Used by CAASD for Airspace Redesign

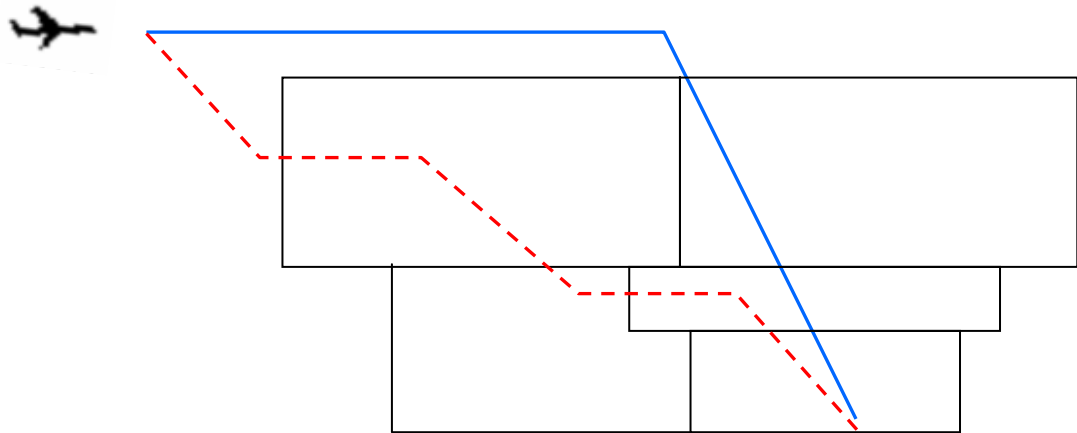
CRCT	Collaborative Routing Coordination Tool	CAASD
DPAT	Detailed Policy Assessment Tool	CAASD
EACM	Enhanced Airfield Capacity Model	CAASD
GRAIL	GRAIL Real-Time ATM Integration Lab	CAASD
GRASP	GRail AirSPace Toolkit	CAASD
IDAT	Intersect Density Analysis Toolset	CAASD
MapInfo		COTS
NIRS	Noise Integrated Routing System	FAA / Metron
SDAT	Sector Design and Analysis Tool	FAA
TAAM	Total Airspace and Airport Modeller	Preston
TARGETS	Terminal Area Route Generation, Evaluation and Traffic Simulation	CAASD

Airspace Analysis

- **Current toolset has gaps for both en route and terminal modeling**
 - En route modeling needs are more challenging
- **Combinations of tools sometimes are necessary to support analysis of proposed airspace changes**
 - Additionally models can be built from scratch
- **Better design tools to be used by design team members helps to create a more streamlined and efficient process**

Existing Gaps in En Route Modeling

- **Altitude restrictions**
 - **Erroneous sector counts**
 - **Modeling trade-offs for existing tools are needed to provide workarounds for existing shortcomings**
 - **GRASP used to support analysis not requiring delay**



Existing Gaps in En Route Modeling

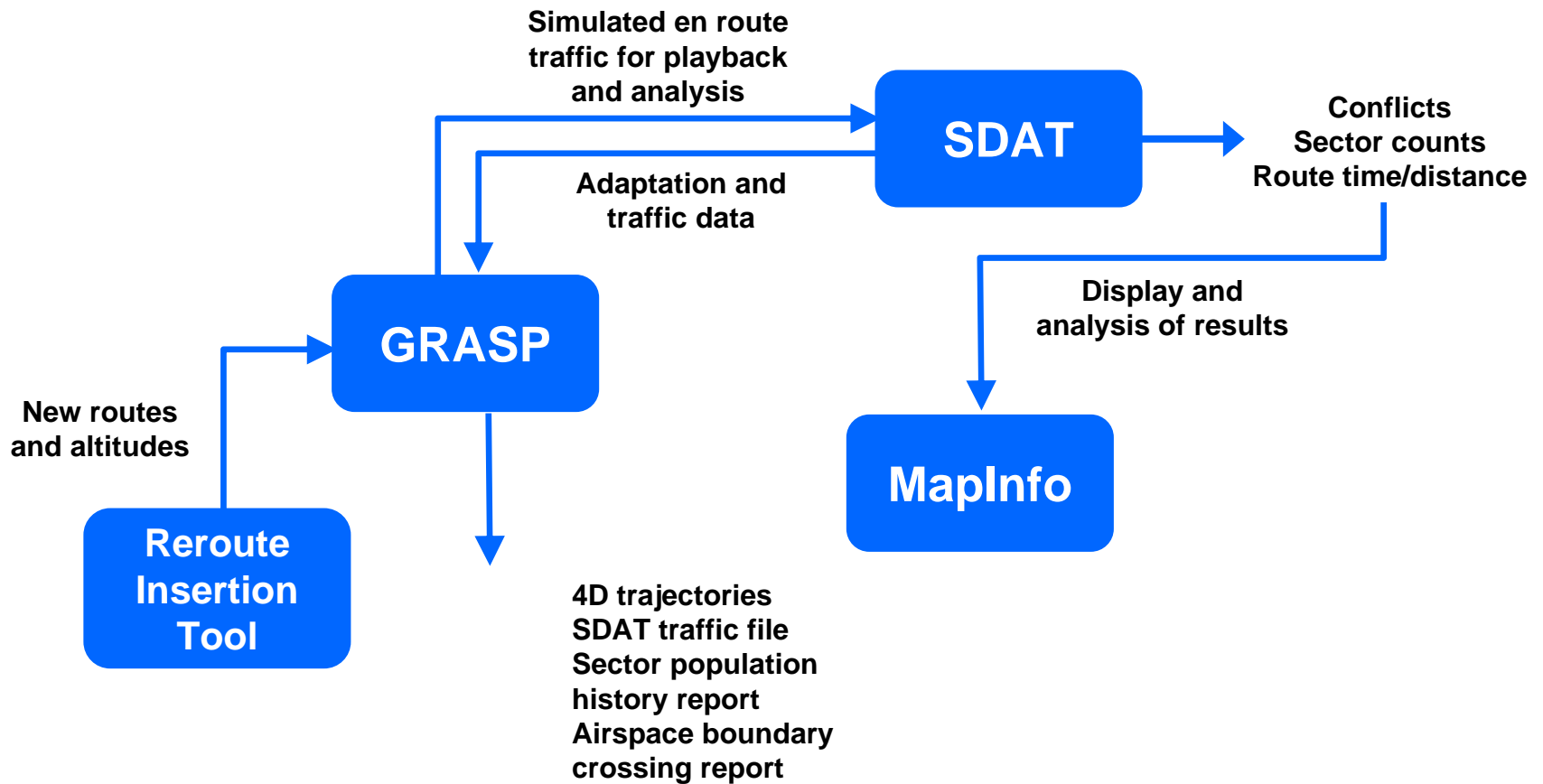
(continued)

- **Appropriate location for delay**
 - Current capabilities suitable for estimating aggregate delays
 - Appropriate location of delay for NAS/Regional/En Route studies more difficult to model
- **Traffic Flow Management initiatives**
 - There is no accepted workload model in United States
 - To overcome current limitations in modeling the need for Traffic Flow Management initiatives, parametric analysis using controller input can be used

GRAIL Airspace Toolkit (GRASP)

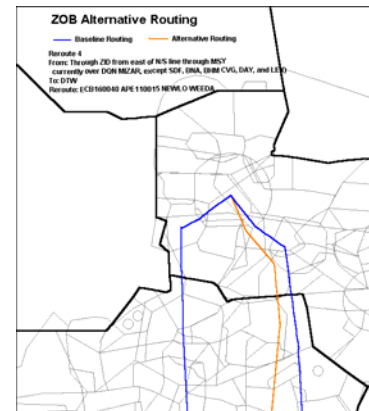
- **GRASP**
 - Provides tools which allow analysts to quickly examine the impact of changes to airspace and aircraft routes
 - **Capability 1: conversion of flight plan to trajectory**
 - Includes restrictions, aircraft type
 - **Capability 2: report generation**
 - Uses trajectories and flight plans
 - SDAT traffic file
 - Sector population history report
 - Airspace boundary crossing report
 - Additional utility reports
- **GRASP used to support large scale airspace projects involving changes to routes and altitude restrictions**

En Route Analysis



GRASP Output

- GRASP output used to:
 - Baseline and alternative sector counts
 - Alternative route depiction
 - Fix loading
 - Sector count differences
 - Flight time and distance differences
 - Traffic animation



		EDT															
		7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00
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	11	27	19	26	28	21	39	28	30	36	25	39	31	37	21	16	12
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	40	17	21	24	31	16	34	39	27	34	49	54	31	33	23	11	8

Shortcomings for En Route

- **No tool able to collectively address each shortcoming**
 - If multiple tools used, changes in airspace design may need to be updated in each model
- **However, workarounds for current en route modeling gaps still exist for**
 - Altitude restrictions
 - Appropriate location for delay
 - Traffic Flow Management initiatives

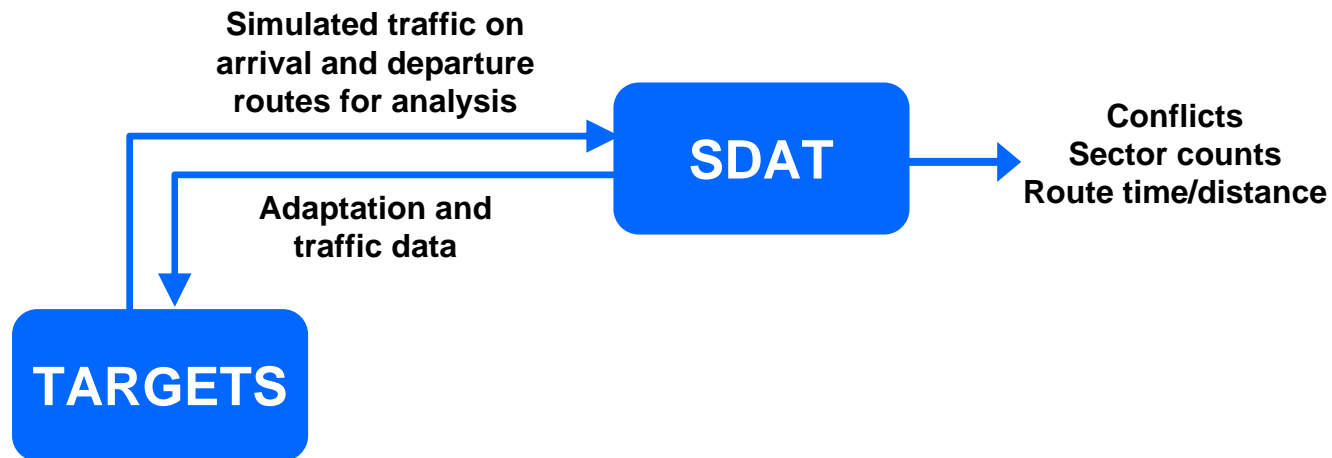
Terminal Modeling Issues

- **Existing toolset has limitations for terminal modeling needs**
 - Holding
 - Paired operations
 - Ground movement
- **Many limitations can be overcome**
 - Workarounds
 - Post processing of data
 - Building models from scratch
- **These efforts can be costly**

Terminal Area Route Generation Evaluation and Traffic Simulation (TARGETS)

- **GIS capability tailored to procedure and airspace design and analysis**
- **Full Procedure Builder**
 - **En Route, Common, and Runway Transitions**
 - **SIDs, STARS**
- **Used to design arrival and departure routes**
 - **May be adequate to determine feasibility of new design if delay is not important**
 - **Designs can be used to input into other tools**
 - **TAAM**
 - **SDAT**

Terminal Area Analysis: *No Delay Analysis Needed*



Terminal Area Analysis: *Delay Analysis*

